



Title	THREE NEW SPECIES OF THE GENUS PARAXENOS (STREPSIPTERA : STYLOPIDAE) PARASITIC ON BEMBIX (HYMENOPTERA : SPHECIDAE) OF SRI LANKA AND AUSTRALIA IN THE COLLECTION OF THE SMITHSONIAN INSTITUTION (Notulae Strepsipterologicae-XVII)
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THREE NEW SPECIES OF THE GENUS *PARAXENOS* (STREPSIPTERA :
STYLOPIDAE) PARASITIC ON *BEMBIX* (HYMENOPTERA :
SPHECIDAE) OF SRI LANKA AND AUSTRALIA IN THE COLLECTION
OF THE SMITHSONIAN INSTITUTION
(Notulae Strepsipterologicae-XVII)*

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Abstract

Paraxenos krombeini, *P. occidentalis*, and *P. australiensis* spp. nov. (Strepsiptera : Stylopidae) are described on the basis of female specimens obtained from *Bembix orientalis* of Sri Lanka, and *B. atrifrons* and *B. musca* of Australia, respectively.

The genus *Bembix* (Hymenoptera : Sphecidae) is little known to be stylopized. Only two European species, *B. oculata* Latreille and *B. rostrata* (Linnaeus) are recorded to be stylopized by *Paraxenos hungaricus* (Székessy, 1955) in Hungary, Germany, and Spain (Kinzelbach, 1978). In addition, there is another record of *B. texana* Cresson which was stylopized by an unidentified species in U. S. A. (Pierce, 1918). By the courtesy of Dr. K. V. Krombein, U. S. A., we were able to examine 5 stylopized *Bembix* specimens collected in Sri Lanka and Australia in the collection of the Smithsonian Institution. Their parasites are apparently new to science as described below.

STYLOPIDAE

Xeninae

Paraxenos krombeini sp. nov.

Five females of this new species were extracted from 2 female and 1 male specimens of *Bembix orientalis* Handlirsch collected in Sri Lanka. One female host harbored 3 female parasites and the other two had one parasite each.

Female (Figs. 1 & 2)

* Contribution from the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka (Ser. 3, No. 225).

Size. Length and maximum breadth of cephalothorax 1.5-1.6 mm and 1.7-2.0 mm, respectively. Breadth at the abdominal junction 1.3-1.6 mm. Total length of body about 6.0-8.0 mm. The specimens from the tristypolized host are smaller than those from the monostypolized hosts in the sizes of the cephalothorax.

Color. Cephalothorax brown ; abdomen whitish.

Structure. Cephalothorax broader than long, trapezoidal ; anterior margin of oral portion roundly protruded ; prespiracular lateral margins of cephalothorax slightly curved ; postspiracular lateral margins more strongly curved ; conspicuously constricted at the abdominal junction. Mandibles almost trapezoidal ; each with a sharp but short, anteriorly directed tooth at the interior angle ; their apices surpassing the anterior margin of cephalothorax. Maxillae triangular, apices slightly rounded, not overlapping the posterior portion of mandibles. Spiracles dorsal, situated at about the level of basal third of cephalothorax. Abdomen cylindrical ; caudal end rounded ; 3 genital openings present on the 2nd to 4th abdominal segments.

No gravid female was obtained.

Male and first larva. Unknown.

HOST. *Bembix orientalis* Handlirsch (Hymenoptera : Sphecidae) (identified by J. van der Vecht & K. V. Krombein).

TYPE MATERIAL: Holotype female, mounted, extracted from a female host harboring 3 female parasites, 4-5R, Ratmalana airport, Col. Dist., Sri Lanka, 19-21. Jan. 1975, K. V. Krombein, P. B. Karunaratne, P. Fernando, & N. V. T. A. Weragoda leg. ; 2 paratopotype females, mounted together, extracted from the same host, 2-3R & 3-4L, same data as the holotype ; 1 paratype female, mounted, extracted from another female host, 3-4R, same locality, 15. Feb. 1975, K. V. Krombein leg. ; 1 paratype female, mounted, extracted from a male host, 3-4R, Ma Villu, Cashew Corp., Man. Dist., Sri Lanka, 17-21. Feb. 1979, K. V. Krombein, T. Wijesinhe, S. Siriwardane, & T. T. Gunawardane leg.

TYPE DEPOSITORY : Holotype is deposited in the Australian National Insect Collection, Canberra.

REMARKS : The present new species is generally allied to *P. hungaricus* (Székessy, 1955) from Europe, the first described species from *Bembix*, but differs from it by the larger size of cephalothorax, protruded mandibles from the anterior margin, and triangular shape of maxillae. Székessy's figure explained as the mandibles of *B. hungaricus* (1955, Abb. 9) does not show the true mandibles but the maxillae. Kinzelbach (1978) correctly illustrates the mandibles (Abb. 34N).

***Paraxenos occidentalis* sp. nov.**

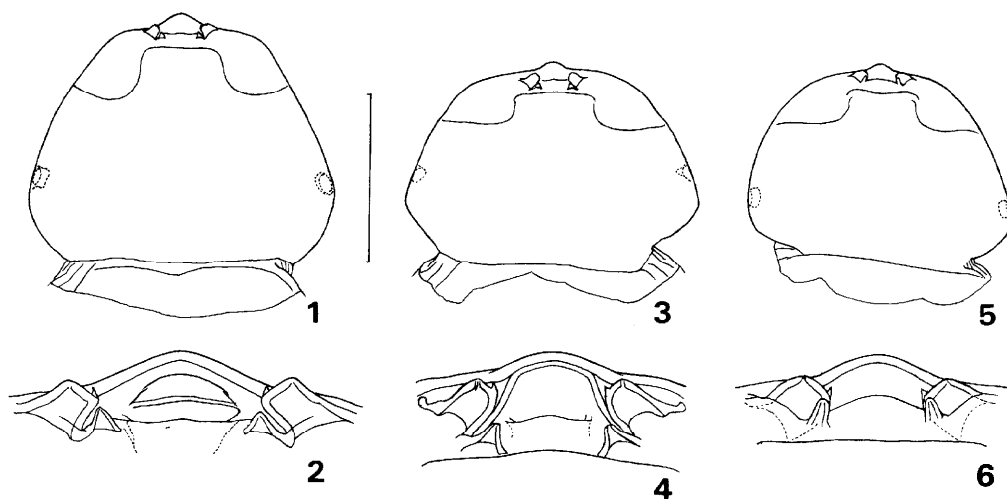
Only a single female and an empty male puparium parasitizing a female of *Bembix atrifrons* Smith collected in Western Australia were examined but are enough to be considered as another new species.

Female (Figs. 3 & 4)

Size. Length and maximum breadth of cephalothorax 1.2 mm and 1.8 mm, respectively. Breadth at the abdominal junction 1.3 mm. Estimated total body length about 5.1 mm.

Color. Cephalothorax brown ; abdomen whitish.

Structure. Cephalothorax remarkably broader than long, hexagonal ; anterior margin of oral portion slightly protruded ; prespiracular lateral margins of cephalothorax roundly continuing to anterior margin ; spiracles almost lateral, situated near the median level of cephalothorax ; cephalothorax broadest at a little posterior to spiracles ; strongly constricted at the abdominal junction. Mandibles oblong, each with a short tooth at the interior angle ; not protruding from the anterior margin of cephalothorax. Maxillae subtriangular, basally expanded ; apices rounded ; slightly overlapping the posterior portion of mandibles at base. Abdomen more or less destroyed, probably



Figs. 1-6. Female cephalothoraces of *Paraxenos* spp. nov. from *Bembix* of Sri Lanka and Australia. 1 & 2 : *P. krombeini* sp. nov. from *B. orientalis* of Sri Lanka. 3 & 4 : *P. occidentalis* sp. nov. from *B. atrifrons* of Australia. 5 & 6 : *P. australiensis* sp. nov. from *B. musca* of Australia. 1, 3, & 5 : Cephalothorax, total ventral view. Scale : 1 mm ; Figs. 2, 4, & 6. Oral portion, enlarged. Scale : 0.25 mm.

cylindrical ; 3 genital openings visible on the 2nd to 4th abdominal segments. Ungravid.

Male and first instar larva. Unknown.

HOST. *Bembix atrifrons* Smith (Hymenoptera : Sphecidae) (identified by H. Evans & R. Matthews).

TYPE MATERIAL : Holotype female, mounted, extracted from a female host, 3-4R, New Beach 24 miles S. Carnarvon, W. Australia, 7. Oct. 1969, H. Evans & R. Matthews leg. The empty male puparium (4-5L) is mounted together on the same slide.

TYPE DEPOSITORY : Holotype is deposited in the United States National Museum.

REMARKS : The present new species is also allied to *P. hungaricus* (Székessy) by its short cephalothorax, but differs from it by rather longer postspiracular lateral margins of cephalothorax.

Paraxenos australiensis sp. nov.

This species is also described on a single female specimen.

Female (Figs. 5 & 6)

Size. Length and maximum breadth of cephalothorax 1.17 mm and 1.59 mm, respectively. Breadth at the abdominal junction 1.10 mm. Estimated total body length about 5.3 mm.

Color. Cephalothorax brown ; abdomen whitish.

Structure. Cephalothorax subtriangular, anterior margin of oral portion slightly protruded, curved ; prespiracular lateral margins gently curved. Mandibles trapezoidal, with round apices, each with a minute, anteriorly directed tooth at the interior angle. Maxillae slender, almost parallel-sided, not so broadened at base ; apices rounded ; almost overlapping the posterior portion of mandibles. Spiracles dorsal, situated at about the level of basal third of cephalothorax. Abdomen as like as the related species ; 3 genital openings present on the 2nd to 4th abdominal segments. Ungravid.

Male and first instar larva. Unknown.

HOST: *Bembix musca* Handlirsch (Hymenoptera : Sphecidae) (identified by H. Evans & R. Matthews).

TYPE MATERIAL: Holotype female, mounted, extracted from a female host, 3-4L, Kuranda & vic., Queensland, Australia, 4-13. Nov. 1972, H. E. Evans leg.

TYPE DEPOSITORY: Holotype is deposited in the United States National Museum.

REMARKS: The present new species is generally allied to *P. occidentalis* sp. nov., but differs from it by smaller size of cephalothorax, shorter distance between the apex and the posterior margin of opening of brood chamber, and posteriorly situated spiracles.

Riek (1970) states that "There are two undescribed genera, one on *Bembix* (10 spp.) and the other on *Bembecinus* (2 spp.)." in Australia. Considering the present two new species from Australian *Bembix*, however, they belong to nothing else of Székessy's subgenus *Bembicixenos* (placed under the genus *Pseudoxenos* at first by him and now synonymized with *Paraxenos*) as like as the Asian species also described here by the shapes of their cephalothoraces being broader than long. The female parasites of some *Sceliphron* (*Paraxenos laetum* (Ogloblin) parasitic on *S. laetum* in New Guinea and Australia and *P. orientalis* Kifune on *S. madraspatanum formosanum* in Japan) have closely allied cephalothoraces to those of *Bembix*. On the other hand, the female parasites of some Old World *Bembecinus* (e. g. *P. biroi* (Székessy) on *B. antipodum* and *P. novaeguineae* (Székessy) on *B. gazagnairei*¹⁾ in New Guinea and *P. nagatomii* Kifune on *B. bimaculatus* in Japan) have such cephalothoraces as more allied to the parasites of *Sphex*, *Isodontia*, or *Ammopkila*. Considering these circumstances, we are inclined to combine together these parasites of *Bembix* and *Bembecinus* with those species parasitic on other sphecids under the genus *Paraxenos*. In fact, Kinzelbach (1971) once took up the subgeneric name, *Bembicixenos*, as a genus, in his table (Tab. 7), but later, he (1971a) synonymized it with *Paraxenos*. We agree with his synonymization.

The females of *Paraxenos* parasitic on the genus *Bembix* are distinguishable by the following key type locality and type host).

KEY TO THE FEMALES OF *Paraxenos* PARASITIC ON *Bembix*

- Cephalothorax a little broader than long; mandibles trapezoidal, protruded from the anterior margin of cephalothorax; intermandibular distance long. Distribution: Sri Lanka. Host: *B. orientalis* *P. krombeini* sp. nov.
- Cephalothorax remarkably broader than long; mandibles not protruding the anterior margin of cephalothorax; intermandibular distance short 2
- Maximum breadth of cephalothorax about 1.0 mm. Distribution: Europe (Hungary*, Germany, & Spain). Hosts: *B. oculata** & *B. rostrata* *P. hungaricus* (Székessy, 1955)
- Maximum breadth of cephalothorax more than 1.6 mm 3
- Spiracles situated at about median level of cephalothorax; maximum breadth of cephalothorax about 1.8 mm. Distribution: Australia (Western Australia). Host: *B. atrifrons* *P. occidentalis* sp. nov.
- Spiracles situated at about basal third of cephalothorax; maximum breadth of cephalothorax about 1.6 mm; lateral margins of cephalothorax gradually curved. Distribution: Australia (Queensland). Host: *B. musca* *P. australiensis* sp. nov.

¹⁾ This is a wrong record. True *gazagnairei* occurs in Africa.

Addendum

Since the strepsipterous fauna of Sri Lanka was once listed by Kifune & Hirashima (1980), several newly described or recorded species have been added to the fauna. Here we present an up-to-date list of the Strepsiptera occurring in Sri Lanka, as follows:

Mengenillidae

1. *Mengenilla orientalis* Kifune et Hirashima, 1980 (♂)

Corioxenidae

TRIOZOCERINAE

2. *Triozocera ceylonensis* Kifune et Hirashima, 1983 (0)

Halictophagidae

TRIDACTYLOPHAGINAE

3. *Tridactylophagus ceylonensis* Kifune et Hirashima, 1980 (♂)

HALICTOPHAGINAE

4. *Halictophagus peradeniya* (Pierce, 1911) (♂, ♀)
5. *H. sodeni* Hofeneder, 1949 (♂, ♀)
6. *H. spectrus* Yang, 1964 (♂, ♀)
7. *H. radialis* Kifune et Hirashima, 1983 (♂)
8. *H. minimus* Kifune et Hirashima, 1983 (♂)

Myrmecolacidae

9. *Myrmecolax nietneri* Westwood, 1858 (♂)
10. *Stickotrema acutipenis* (Kogan et Oliveira, 1964) (0)
11. *S. ceylonense* Kifune et Hirashima, 1980 (♂)
12. *S. ambiguum* Kifune et Hirashima, 1980 (0)
13. *S. krombeini* Kifune et Hirashima, 1980 (0)
14. *S. simile* Kifune et Hirashima, 1980 (♂)
15. *S. minor* Kifune et Hirashima, 1980 (♂)

Stylopidae

XENINAE

16. *Paraxenos krombeini* Kifune et Hirashima, sp. nov. (♀)

Riek (1970) states that there are 93 species of the Strepsiptera in Australia, most of which are undescribed. So far as we are aware, the following 15 species are described or recorded from Australia until today.

Mengenillidae [8 spp.*]

1. *Mengenilla gracilipes* (Lea, 1910) (♂)
2. *M. australiensis* Kifune et Hirashima, 1983 (♂)

Corioxenidae [6 spp.]

TRIOZOCERINAE

3. *Triozocera papuana* Kogan et Oliveira, 1964 (♂)

Halictophagidae [21 spp.]

CORIOPHAGINAE

4. *Coriophagus rieki* Kinzelbach, 1971 (♂)

HALICTOPHAGINAE

5. *Halictophagus australensis* Perkins, 1905 (♂, ♀)
6. *H. phaeodes* Perkins, 1905 (9)

* Numbers of the species occurring in Australia indicated by Riek (1970).

7. *H. stenodes* Perkins, 1905 (♀)
8. *H. schwarzii* Perkins, 1905 (♂)
9. *H. tryoni* Perkins, 1905 (♀, ♂-puparium)

Elenchidae [2 spp.]

DEINLENCHINAE

10. *Deinelenchus australensis* Perkins, 1905 (♀, ♂-cephalotheca)

Dipterophagidae

11. *Dipterophagus daci* Drew et Allwood, 1985 (0, ♀, 1L)

Myrmecolacidae [3 spp.]

Stylopidae [53 spp.]

XENINAE

12. *Paragioxenos brachypterus* Ogloblin, 1923 (0, ♀)
13. *Paraxenos laetum* (Ogloblin, 1926) (♀, 1L)
14. *P. occidentalis* Kifune et Hirashima, sp. nov. (♀)
15. *P. australiensis* Kifune et Hirashima, sp. nov. (♀)

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